CLAIMS

1. A illumination system comprising: an arc tube including a light-emitting portion for emitting light between electrodes and sealing portions arranged on both sides of the light-emitting portion; a first reflecting mirror arranged on the rear side of the light-emitting portion along the longitudinal direction of the arc tube; and a second reflecting mirror arranged on the front side of the light-emitting portion,

the diameter D1 on the reflecting surface of the first reflecting mirror, indicated by the available marginal light emitted to the rear side from the light-emitting portion, is larger than the diameter d1 of the outer surface of the second reflecting mirror; and the diameter d1 of the outer surface of the second reflecting mirror is set to a size within the light of the available marginal light reflected by the first reflecting mirror; and

the reflecting surface of the second reflecting mirror surrounds about half of the front side of the light-emitting portion and the light emitted from the center of the light-emitting portion and incident on the second reflecting mirror and the normal of the second reflecting mirror agree with each other.

2. A illumination system comprising: an arc tube including a light-emitting portion for emitting light between electrodes and sealing portions arranged on both sides of the light-emitting portion; a first reflecting mirror arranged on the rear side of the light-emitting portion along the longitudinal direction of the arc

tube; and a second reflecting mirror arranged on the front side of the light-emitting portion,

the diameter D1 on the reflecting surface of the first reflecting mirror, indicated by the available marginal light emitted to the rear side from the light-emitting portion is larger than the diameter d1 of the outer surface of the second reflecting mirror; and the diameter d1 of the outer surface of the second reflecting mirror is set to a size within the light of the available marginal light reflected by the first reflecting mirror;

the second reflecting mirror is arranged so that the light emitted from the center of the light-emitting portion and incident on the second reflecting mirror and the normal of the second reflecting mirror agree with each other; and

the diameter D2 at the opening end of the reflecting surface of the first reflecting mirror is within the range that satisfies $\theta e > \theta d$ when θd is approximated by equation 1,

$$\theta d = 90° + \tan^{-1}\{(Le/2+Lr)/(d2/2)\} \text{ --- Equation 1}$$

where Le is the distance between the ends of the electrodes, Lr is the distance on the optical axis of the illumination system from the center F1 between the ends of the electrodes to the opening end of the reflecting surface of the second reflecting mirror, d2 is the diameter of the opening end of the outer surface of the second reflecting mirror, D2 is the diameter of the opening end of the reflecting surface of the first reflecting mirror, θd is the angle formed between the light emitted from the end of the electrode of the

electrode ends adjacent to the first reflecting mirror without interception by the second reflecting mirror and the straight line of the optical axis of the illumination system extending toward the rear side of the illumination system, and θe is the angle formed between the line connecting the opening end of the reflecting surface of the first reflecting mirror and the end of the electrode adjacent to the first reflecting mirror together and the straight line of the optical axis of the illumination system extending toward the rear side of the illumination system.

3. A illumination system comprising: an arc tube including a light-emitting portion for emitting light between electrodes and sealing portions arranged on both sides of the light-emitting portion; a first reflecting mirror arranged on the rear side of the light-emitting portion along the longitudinal direction of the arc tube; and a second reflecting mirror arranged on the front side of the light-emitting portion,

the diameter D1 on the opening end of the reflecting surface of the first reflecting mirror, indicated by the available marginal light emitted to the rear side from the light-emitting portion, is larger than the diameter d1 of the outer surface of the second reflecting mirror; and the diameter d1 of the outer surface of the second reflecting mirror is set to a size within the light of the available marginal light reflected by the first reflecting mirror;

the second reflecting mirror is arranged so that the light emitted from the center of the light-emitting portion and incident on

the second reflecting mirror and the normal of the second reflecting mirror agree with each other; and

the diameter D2 of the opening end of the reflecting surface of the second reflecting mirror has a size that allows reflection of the boundary light of the light emitted from the end of the arc generating between the electrodes adjacent to the first reflecting mirror without interception by the second reflecting mirror.

4. The illumination system according to one of claims 1 to 3, wherein the available marginal light is marginal light determined depending on the structure of the arc tube.

5. The illumination system according to one of claims 1 to 4, wherein the second reflecting mirror is arranged to the outer periphery of the light-emitting portion with a space therebetween.

6. The illumination system according to one of claims 1 to 5, wherein the reflecting surface of the second reflecting mirror is formed of a dielectric multilayer that transmits ultraviolet light and infrared light.

7. The illumination system according to one of claims 1 to 6, wherein the reflecting surface of the second reflecting mirror is formed by face-grinding or press-molding a pipe having an inside diameter larger than the outside diameter of the sealing portion.

8. The illumination system according to one of claims 1 to 7, wherein the outer surface of the second reflecting mirror is formed so as to allow the light incident from the reflecting surface side to transmit.

9. The illumination system according to one of claims 1 to 7, wherein the outer surface of the second reflecting mirror is formed so as to diffuse-reflect the light incident from the reflecting surface side.

10. The illumination system according to one of claims 1 to 9, wherein the second reflecting mirror is made of any of quartz, light-transmissive alumina, crystal, sapphire, YAG, and fluorite.

11. The illumination system according to one of claims 1 to 10, wherein the outer circumference of the light-emitting portion is coated with antireflection coating.

12. The illumination system according to one of claims 1 to 11, wherein the second reflecting mirror is firmly fixed to the surface of the sealing portion in the vicinity of the light-emitting portion with an adhesive.

13. The illumination system according to claim 12, wherein the adhesive is an inorganic adhesive containing a mixture of silica and alumina or aluminum nitride.

14. The illumination system according to one of claims 1 to 12, wherein the second reflecting mirror is pressure-fixed to the vicinity of the light-emitting portion of the arc tube with a spring wound around the outer circumference of the sealing portion with a space therebetween.

15. The illumination system according to claim 14, wherein the spring is formed of a conductive winding, one end of the conductive winding being connected to a lead wire extending from the

sealing portion opposite to the spring.

16. A projector comprising a illumination system and an optical modulator for modulating an incident light from the illumination system in accordance with given image information, wherein the illumination system according to one of claims 1 to 15 as the illumination system.

17. A method for manufacturing a illumination system comprising: an arc tube including a light-emitting portion for emitting light between electrodes and sealing portions arranged on both sides of the light-emitting portion; a first reflecting mirror arranged on the rear side of the light-emitting portion along the longitudinal direction of the arc tube and serving as a main reflecting mirror; and a second reflecting mirror arranged on the front side of the light-emitting portion and serving as an auxiliary reflecting mirror, comprising the steps of:

fixing the arc tube and the second reflecting mirror together, after adjusting the relative position between the second reflecting mirror and the arc tube such that the real images of the electrodes or the real image of an interelectrode arc of the arc tube overlap with the reflected images of the electrodes or the reflected image of the interelectrode arc reflected by the second reflecting mirror; and

fixing the arc tube and the first reflecting mirror together, after arranging the arc tube and the first reflecting mirror such that the center of the electrodes of the arc tube having the second reflecting mirror fixed thereto substantially agrees with a first

focus of the first reflecting mirror and adjusting the relative position between the arc tube and the first reflecting mirror so that the luminance of the first reflecting mirror is maximum in a specified position.

18. The method for manufacturing a illumination system according to claim 17, wherein the step of fixing the arc tube and the second reflecting mirror together comprises the process of detecting the real image and the reflected image from at least two directions by using a pickup image with a camera, adjusting the position of the second reflecting mirror so that the real image overlaps with the reflected image in each direction, and fixing the arc tube and the second reflecting mirror together.

19. The method for manufacturing a illumination system according to claim 17 or 18, wherein the specified position is a design second focus of the first reflecting mirror; and the step of fixing the arc tube and the first reflecting mirror together comprises the process of fixing the arc tube and the first reflecting mirror together after adjusting the relative position between the arc tube and the first reflecting mirror so that the luminance in the vicinity of the design second focus of the first reflecting mirror is maximum.

20. The method for manufacturing a illumination system according to claim 17 or 18, wherein the specified position is the position at which an illumination object of an optical system that mounts the illumination system is arranged; and the step of fixing

the arc tube and the first reflecting mirror together comprises the process of fixing the arc tube and the first reflecting mirror together after incorporating the illumination system to the optical system and adjusting the relative position between the arc tube and the first reflecting mirror so that the luminance at the position in which the illumination object is arranged, becomes maximum.